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CASE REPORT

Successful hybrid treatment of a rare case of blunt traumatic rupture of the left atrial basal appendage and aortic arch

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Abstract
Despite advances in emergency care and the emergent transportation system, cardiac and aortic ruptures after blunt trauma are associated with high mortality and morbidity. We present a rare case of a 70-year-old man with a ruptured left atrial basal appendage and distal aortic arch after sustaining blunt trauma to the chest during a motor vehicle accident. The patient was transported to our hospital in a state of shock and taken directly to the operating room. Hybrid treatment was performed, including surgical repair of the left atrium under cardiopulmonary bypass and thoracic endovascular aortic repair, was performed. The patient fully recovered without any complications.

Keywords Cardiac trauma · Aortic trauma · Endovascular aortic repair

Introduction

Cardiac or aortic rupture due to blunt thoracic trauma is rare, but associated with high mortality and morbidity. The incidence of blunt cardiac/aortic rupture has increased, although advances in traumatology and prehospital management, the development of focused assessment with sonography for trauma (FAST), ultrasound imaging, the rapid availability of whole-body computed tomography, and improved transportation systems [1]. We report successful management of a patient with left atrial basal appendage and distal aortic arch rupture secondary to blunt trauma sustained during a motor vehicle accident.

Case

A 70-year-old man, with an unknown past medical history, was brought in ambulance following a motor vehicle accident. On arrival to the regional hospital, the patient was in a state of shock. A contrast-enhanced computed tomography (CT) scan at the time showed a massive hemorrhagic pericardial effusion with extravasation of contrast into the mediastinum (Fig. 1a, b). The bleeding point was supposed to be the aortic isthmus. An emergent pericardiocentesis was performed and fluid resuscitation was initiated. The patient's vital signs improved with massive blood transfusion. Despite this, he was transferred via helicopter to our hospital due to an injury severity score of 26 and concern for traumatic cardiac and aortic injury. On arrival to our facility, he was transported directly to the operating room for emergency surgery. During median sternotomy, a large hemopericardium with bleeding from the left atrial basal appendage was observed and controlled digitally. A single laceration of approximately 30 mm in length was detected (Fig. 2). The laceration was repaired with a 4–0 Prolene mattress suture and Teflon felt under extracorporeal circulation with induced cardiac arrest. To prevent air embolism from the left atrial appendage, both lungs were inflated by an anesthesiologist directly prior to finishing the repair of the left atrial appendage with sutures. After decannulation, a stent-graft was endovascularly inserted into his distal aortic arch to cover the aortic isthmus via the right femoral artery. Postoperatively, the patient experienced no complications and was discharged home on the 27th postoperative day.

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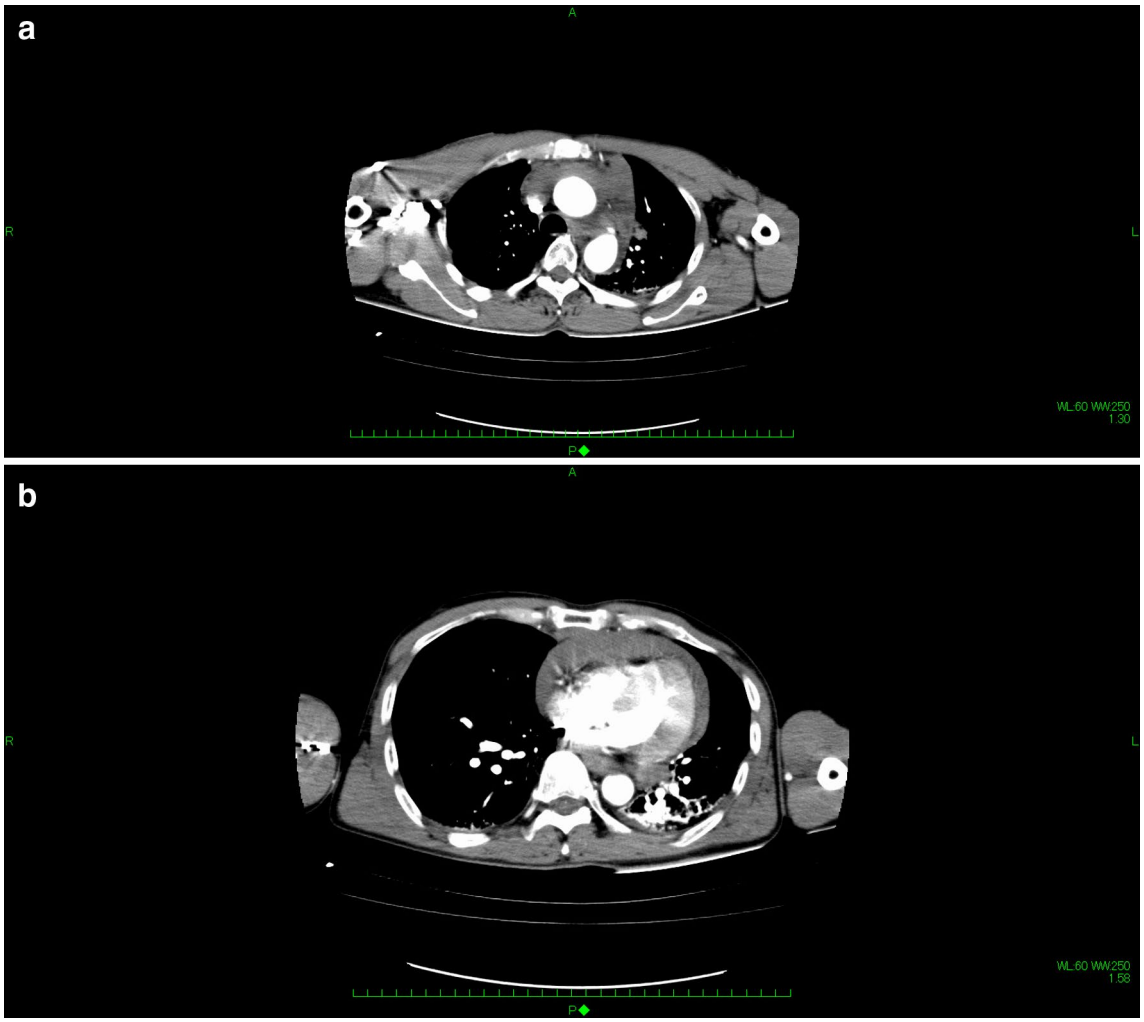

Fig. 1 Massive hemorrhagic mediastinal hematoma and a little extravasation of contrast in mediastinum (**a**). Massive pericardial effusion was detected in left atrial level (**b**)

Discussion

Previous reports estimate the incidence of blunt traumatic cardiac rupture to be 0.16–2% of hospital trauma admission [1]. However, cardiac rupture is rarely diagnosed in patients with blunt chest trauma because 80% of patients die from cardiac tamponade, intrathoracic hemorrhage, and exsanguination at the scene of the accident [2]. In a meta-analysis of 303 autopsy patients, Raid et al. [3] reported the following sites of rupture: right ventricle, 121 patients (40%); right atrium, 101 patients (33%); left ventricle, 96 patients (36%); and left atrium, 47 patients (16%). The same team also reported that the majority of left atrial injuries occurred in the atrial appendage and the pulmonary vein–atrial junction. In regards to the mechanism of cardiac rupture, motor vehicle accidents account for the majority of cases. Tanoue et al. [4] was the first to report a case of a ruptured atrial basal appendage and proposed that, in this case, the anatomically fixed left atrium was dilated while the non-fixed left ventricle swung like a pendulum at the time of injury.

In an autopsy series, 47–49% of blunt cardiac injuries also presented with thoracic aortic injury [3]. However, due to high prehospital mortality, cases of multiple injuries are rarely seen in the hospital setting. Double ruptures are particularly uncommon. To the best of our knowledge, our case is the first report of successful repair for simultaneous rupture of both the left atrial basal appendage and the aortic arch.

In our case, we adopted median sternotomy approach as our preoperative survey revealed hemopericardium with no clear site of bleeding. Because of this, we considered bleeding from the aortic ishmus, which could be managed with this approach via total aortic arch replacement under cardiopulmonary bypass with circulatory arrest. In addition,

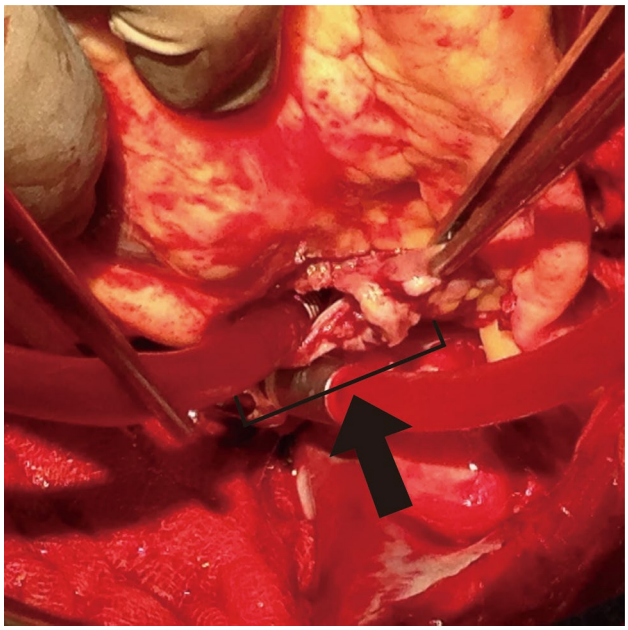

Fig. 2 A single laceration of about 30 mm along atrioventricular groove

if massive bleeding was not detected from distal arch, we considered that it could be managed with stent-graft insertion. We also controlled bleeding from the left atrial basal appendage and aortic isthmus via left thoracotomy. However, this approach did not allow for the control of bleeding from the right atrium or right ventricle.

Typically, it is ideal to repair cardiac injury without heparinization, so as to prevent increased bleeding. We decided not to repair the left atrium with off-pump beating surgery due to the proximity of the tear or the atrioventricular groove and circumflex artery.

Blunt aortic injury is found in 0.1–0.6% of patients following serious trauma [5]. Gale et al. reported improved results using endovascular aortic repair of traumatic thoracic aortic transections, in comparison to those who were managed with open surgery [5]. Endovascular repair may be a valid approach.

Rupture of the left atrial basal appendage and aortic arch is extremely rare. Despite our patient's severe hypotension on arrival to our facility, atrial repair via median sternotomy followed by endovascular aortic repair resulted in good outcomes.

Conclusion

We presented a case of blunt traumatic rupture of the left atrial basal appendage and the distal aortic arch due to a motor vehicle accident. Despite the rare site of bleeding and unstable hemodynamics seen in this case, we demonstrate that appropriate strategies result in favorable outcomes.

Compliance with ethical standards

Conflict of interest Yuki Ikeno has no conflict of interest. Yoshikatsu Nomura has no conflict of interest. Masamichi Matsumori has no conflict of interest. Yasuko Gotake has no conflict of interest. Hidekazu Nakai has no conflict of interest. Takashi Matsueda has no conflict of interest. Katsuhiro Yamanaka has no conflict of interest. Takeshi Inoue has no conflict of interest. Hiroshi Tanaka has no conflict of interest. Yutaka Okita has no conflict of interest.

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